

Research on User Experience Design of Home Appliances Suitable for the Elderly in the Digital Life Era

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Abstract: Under the background of the continuous development of home appliances suitable for the elderly in the digital life era, according to the research and practice status of home appliances suitable for the elderly user experience, the research is carried out from the three dimensions of the user experience design of home appliances suitable for the elderly: beyond the instrumental, user's emotion and affect, and the experiential. Combining the characteristics of user experience design of home appliances suitable for the elderly in the digital life era, the paper analyzes from five aspects: basic user needs, technology driving, user perception, interactive interface and product scene segmentation. Put forward user experience design suggestions that adapt to the new needs of the elderly, adapt to various scenarios in the home, and enable elderly users to "self-empower" and "mutually empower" when using home appliances, in order to provide reference for subsequent related design and research.

Keywords: Digital Life, Home appliances for old age, User experience, Case study

1. Introduction

Digital life is a new way of life . Nicholas Negroponte, an American scholar, put forward the term digital life for the first time in his book Digital Survival published in 1996. People live in the virtual digital activity space and use digital technology to engage in information transmission, communication, learning, work and other activities . "Digital life" integrates the objective world and the digital world, to make people's lifestyle and life concept presenting digital characteristics [3]. Its goal is to let all people at any time, any place, use any device to keep in touch with the network, so as to meet the material premise of their own development, get spiritual satisfaction, and finally achieve the purpose of enjoying a more convenient, safe, happy and happy life. New social spatial relationships across regions, cultures and social systems are established among people. Nature, society and man can be understood in a more convenient way, and the allocation of resources can be rearranged more efficiently and rationally. In digital life, the goal is to reduce the cost of acquiring the material and spiritual resources needed for all-round development. Digital life is based on digital technology and is a reshaping of the entire lifestyle [4].

In the aging trend of society, the silver market has gradually become a new consumption force. On April 25, 2021, a seminar titled "Internet and Elderly Care: Opportunities and Challenges in the Digital Age" was held in Beijing, sponsored by the Population and Development Research Center of Renmin University of China and the Beijing Institute of Social Construction of Renmin University of China. Scholars have launched a heated discussion on the "digital divide" faced by the elderly in the digital age, and discussed how to make the Internet effectively assist the elderly in providing for the aged and how to make the elderly enjoy the benefits of the digital age. [5] The digital divide is widespread in the whole age population, and its impact is most obvious in the elderly. The elderly are generally lower than users of other age groups in terms of cognitive and operational abilities. In today's "digital life," it is difficult to realize the macro ideal that everyone can enjoy the convenience of the digital age. Therefore, the combination of user experience research and product innovation design is the requirement and necessity for the development of aging products or systems in the digital life era. This paper analyzes and summarizes the current development status of user experience design for aging home appliances, and discusses the trends and challenges of user experience design for the future, so as to provide a direction for future research.

2. Overview of domestic and foreign research on design of suitable home electric appliance in "digital life" era

2.1 Development of design concepts for home appliances suitable for the elderly

In the 1990s, Britain, Japan and other countries that were the first to enter the aging society put forward the idea that household appliances for the elderly should be different from ordinary household appliances and focus on "health, safety, economy, convenience and intelligence" [6]. At present, China's population continues to aging, facing social security, economic development, cultural identity and other complex issues. The definition of suitable hometown electricity has important guiding significance for constructing "harmonious aging", "scientific aging" and "active aging" and promoting the sustainable development of home appliance industry [7]. In recent years, a series of relevant design criteria for home electric have been released in China, as shown in Table 1.

Table 1 Design criteria for aging household appliances

Guidelines issued	name	main content
In April 2018	Old electrical standard	This standard is to make the existing products conform to the general standard for the use of the elderly, which is mainly aimed at the situation of the elderly group to use the product, to evaluate and analyze.

chinaXiv:202301.00048v1

In December 2018	Guidelines for the design of household appliances for the elderly	This standard is aimed at the old people because of the aging characteristics of the use of a variety of adverse effects, put forward the common, frame of the appliance design elements.
In December 2018	Specification for user interface design of household appliances for the elderly	This standard defines user interface elements, design requirements, and design evaluation for household and similar appliances that consider the needs of older persons.
In November 2020	The circular on effectively solving the difficulties of the elderly in using intelligent technology to facilitate the elderly to use intelligent products and services	This standard aims at the difficulties encountered by the elderly in daily use of intelligent products and services, so that the elderly can have more sense of gain, happiness and security in the development of information technology.
In June 2021	Adaptive aging technology for intelligent household appliances	This series of standards includes 5 group standards and 4 company technical specifications, covering 8 categories of products including air conditioner, refrigerator, washing machine, TV set, range hood, water purifier (water dispenser), toilet seat cover and water heater.
In August 2021	Architecture model of intelligent household appliance system for elderly living assistance	This standard specifies the architecture model and definition of the intelligent household appliance system used to assist the life of the elderly, and the use case examples of the architecture model.
In August 2021	General technical requirements for household appliances for the elderly	This standard focuses on the safety of household appliances and specifies the safety and ease-of-use requirements for household and similar appliances intended for use by the elderly.

In response to the digital divide in the use of smart home appliances by the elderly, my country has issued four relevant design standards and notices, clearly pointing out that it is necessary to concentrate on solving the difficulties encountered by the elderly when using smart products and enjoying smart services on a daily basis. The release of these design guidelines also provides design guidance for the design of home appliances suitable for aging, and has a clearer idea of "suitable for the elderly" hardware and software of products. Through the relevant guidelines, we can see that the main focus of the design of home appliances suitable for the elderly in my country is the ease of use and safety of the products, and the safety of users is guaranteed under the condition that the home appliances are suitable for use. It adheres to the concept and goal of "adapting to aging", and strives to make the elderly feel that the products are "safe, useful, easy to use, easy to use, pleasant and economical" at the level of user perception and impression, and feel the care and attention of products and services for them. Inclusive; at the product level, all aspects of product design are fully considered, and through targeted improvement of each design element, it can truly meet the needs and perceptions of elderly users, improve their experience and acceptance of products, and finally achieve "suitable for the elderly".

2.2 Research status of user experience design of home Appliances Suitable for the Elderly

As early as the end of the 20th century, Sandhu J (1993) from Northumbria University in the UK studied the design of kitchen appliances based on the assessment of elderly users and summarized a series of imperfect man-machine characteristics [8]. Koppa RJ et al. (1989) from Texas A&M University studied the design of refrigerators for the elderly with ergonomic methods and proposed a series of design criteria [9]. Since then, the foreign research on user experience of suitable native electric gradually expanded from man-machine engineering to universal design, barrier free design, interactive behavior and user psychology, etc., focusing on the use of a variety of design theories and methods. Attach importance to user-friendly and human emotional care. At present, the research on user experience in China is mainly based on the user experience beyond the instrumental, emotion and affect, and the proposed by Hassenzahl and Tractinsky (2006) Experiential is studied from three dimensions [10]. Beyond the instrumental dimension: meeting the basic needs of users at first, and at the same time meeting the underlying needs of human beings through technology -- the need to be stimulated, to improve skills and knowledge, and to grow. From the perspective of user needs, a series of design principles are put forward centering on the psychology and emotion of elderly consumers. In her research, Zhu Jing (2012) focused on the design of an intelligent washing machine that is convenient for the elderly to use, and explored the design method of an intelligent washing machine suitable for the elderly to improve their use experience. The living conditions, physiological and psychological behaviors of the elderly were analyzed, and the intelligent characteristics and design trends of washing machines were analyzed. "User-centered" research method and context-based user experience design method are adopted to set user roles, construct situational stories and construct user experience demand hierarchy [11]. From the perspective of technology driven by wisdom can assign the existing optimal aging electrical appliances product development, widen the elderly for

optimal cognitive aging home appliance, at the same time through the barrier-free design to improve the elderly for the utilization of the intelligent home appliance, promoting the elderly to enjoy the dividends of the digital life era, so that it can develop in harmony with the times. Qin Jingyan et al. (2019) studied human-computer interaction changes brought by artificial intelligence intervention in products, and analyzed the forms and differences of product interaction at the present stage. Combined with the initiative research of related intelligent products, the active interaction form and design key points of intelligent home products are proposed to improve the use efficiency of intelligent products[12].

Emotion and Affect: It mainly emphasizes the importance of users' emotions and pays attention to users' positive emotional feedback during product use, such as joy, fun and pride. In their research, Li Xing et al. (2017) analyzed the preference factors of the elderly in using kitchen appliances from the perspective of the elderly's feelings and emotional experience of using electric appliances, using research methods such as perceptual image measurement, semantic analysis difference and visual simulation scale. At the same time, combined with the theories of product semantics, design psychology and other disciplines, the CMF design principles for old kitchen appliances are analyzed, summarized and summarized [13].

The Experiential dimension: emphasize product usage scenarios, user experience and interactive experience, so that the product is positively recognized by users. From the perspective of usage scenario, Jia Xiaoyan (2019) focuses on the research of experience design of kitchen appliances for the elderly. According to the physiological and psychological characteristics of the elderly and cooking behaviors in the kitchen scene, the experiential design elements of the elderly kitchen appliances are discussed from the experience level, so as to improve the experiential design process of the elderly kitchen appliances [14].

Listed companies such as Haier, Midea and Hisense have invested money to promote the design and promotion of Jijiadian. Now, we have launched compatible products such as intelligent kitchen appliances, intelligent living room and intelligent bathroom, which are friendly to the elderly. The size, appearance, function, operation steps and other aspects of the product are optimized by considering the human-computer interaction scale, safety, health and other aspects of the elderly. At the same time, the digital technology can assign can also promote our country aging electrical appliances product and service innovation and development, rely on an open data sharing and effective use of resources, product diversification and effective supply of heterogeneous user demand precise matching, drive home appliance industry from mass production to personalization, personalization and the transformation of precision manufacturing services [4].

3. Case study on user experience design of Home Appliances Suitable for the Elderly

In the era of "digital life", the way of information transmission between things brings a series of changes to home appliances suitable for the elderly, and also brings more possibilities and challenges to human-computer interaction. With the progress of digital technology and social development, the extension of the concept of digital life continues to expand, and more and more smart household

appliances and services are applied to family life. In order to help elderly users use these products and services efficiently and joyfully, the importance of user research and design is increasingly prominent.

3.1 User experience design that meets basic needs

The design of the hardware and software of the product requires "learning from each other" according to the physiological function requirements of the elderly users, so that the product can make up for the "disability", "dementia" and other deficiencies of the elderly [15]. In 2015, Panasonic introduced an elder-friendly washing machine in Japan, making it easier to pick up and unload clothes. In addition, the basic elements of the elderly are different, and the "self" appeal of each elderly person needs to be respected and customized according to the specific situation of individuals or ethnic groups. For example, the brand such as elephant seal and Mitsubishi motor is also constantly bringing forth the new design of their own rice cooker in view of the demand of the elderly in recent years, from simple key changes to taste to cater to the dietary habits of the elderly. Pay attention to the personalized needs of individuals or small groups of user experience services, so as to improve the pleasure of the elderly using smart appliances.

3.2 Technology-driven user experience design

The development of a variety of new technical means and methods also provides more possibilities for the research dimension of user experience, including artificial intelligence, big data, cloud computing, Internet of Things and other technologies, which have become a new trend in the research of many user experience fields [16]. Intuition Robotic of Israel launched ElliQ, an intelligent robot named "Activity Companion for the Elderly", to help the elderly communicate with their family members online by voice without learning complicated skills of operating smart devices. Through the content and ways of interaction in daily life, the elderly are encouraged to actively learn and integrate into digital life. The rights of the elderly are fully respected and digital inclusive space is provided.

3.3 User perceived experience design

In order to meet the aging requirements of traditional home appliances and smart home appliances, it is necessary to provide users with different levels and depths of cross-channel perception information content in different scenarios to improve user experience. In practice, information perceived by different channels will bring different experiences to users [17]. Haier Smart Home provides users with different channel perception information content combined with home scene. In the visual channel, the sensory information of the visual channel can be changed to enhance some sensory stimulation changes of the elderly, such as enhancing the contrast between light and shade, texture adjustment and other visual elements. In the tactile channel, the demand is expressed through voice interaction, and the product automatically sets the mode and parameters after recognizing the voice. It provides intelligent scene solutions for the elderly with multi-sensory channel content such as living, eating, air, water and entertainment.

3.4 User experience design of the interactive interface

In the process of using suitable home appliance products, there are common problems such as cognitive impairment and inconvenient use in the interface design of home appliance products, which cause great trouble for the elderly in their daily operation. In view of the problems existing in the current stage of the elderly users, China encourages enterprises to optimize their related products, make the interface simple, simple operation, launch large font, large ICONS, one-click operation and other convenient functions. Input a more comprehensive dialect speech recognition library to avoid the elderly who can't speak Mandarin can't get the convenience of life brought by intelligent products. In addition to the APP interface connected to the products, the experience of the product interaction interface of the appliances for aging is also simple and clear. For example, Vivo's vacuum cleaner designed for the elderly enlarges the switch design of the product by removing redundant buttons, so that the elderly can have a very clear view of the function and operation of the product interface when using it.

3.5 Experience design of product scene segmentation

With the development of smart home in the era of "digital life", "scene" has become a new subject in the design of household appliances for aging. The yixiang set released by Midea starts from the kitchen life scene that the elderly are in frequent contact with, and launches the "peace of mind three-piece set" featuring safe smoke stove burning, which actively compensates for the "loss of wisdom" in the life of the elderly group and brings more safe use experience to the elderly users. For example, Midea Yixiang gas water heater CA3 adopts intelligent core chip + high-precision sensor to detect and monitor CO concentration in the installation environment, ensuring the safety of home appliances for elderly users by means of intelligent product detection. Product testing to ensure user safety, so that the elderly for the home electric "uneasy" psychological relief. At the same time, through the product can also have more contact with children, so that the user experience experience of Suitable Hometown electric not only stay in the product availability stage. With the continuous development of user experience research, the paradigm of experience design has changed, and experience has become a design object from a criterion. In the third Session of HUAWEI CONNECT, HUAWEI put forward the full-scene scheme. Through full-scene connection, it changed the traditional product interaction mode to carry out human-computer interaction in the existing home scene, so as to obtain pleasant life experience and experience feelings [18].

4. Trends and challenges

4.1 Analysis on the development trend of user experience design for Hometown TV in the era of "digital life"

Based on the PEST model, the research and practice of home appliances for the elderly are compared from four fields of politics, economy, society and technology, and their development trends and challenges in the current environment are analyzed. In 2020, the my country Development Foundation released the "China Development Report 2020: Development Trends and Policies of China's Population Aging". The report predicts that my country will move from an aging society to an aging society around 2022. At present, the problem of aging services is becoming a long-term, fundamental and restrictive factor affecting the improvement of my country's multi-level social security system and the sustainable and high-quality economic development, and may also be transformed into a major opportunity to promote the coordinated development of society and economy [19]. With the progress of aging and urbanization, a sound social security system and the continuous improvement of housing value, good social and economic conditions are directly or indirectly reflected in healthy behavior habits, active work and lifestyle, abundant material and medical resources, Caring for the living environment of the elderly has improved the living standards of the elderly [20]. China has the largest consumer market and national policy support, but my country's aging-friendly home appliance industry has not yet formed a unified standard, and the aging-friendly home appliance products among companies are not compatible with each other. -It will be gradually improved within 5 years.

With the diversification of educational channels, the educational level of the elderly has also improved, and their requirements for quality of life have increased significantly, and they are more eager to live a healthier and more dignified life in their later years [21]. Changes in the lifestyles and ideological concepts of the elderly have led to significant changes in their consumption needs and consumption structure. The overall trend is quality, diversification, personalization, facilitation, etc., gradually moving from satisfying basic material needs to satisfying psychological enjoyment needs [22], which makes the user experience of any old-fashioned home appliance have individual differences.

In the era of "digital life", the development of 5G technology and the use of smart devices have enabled aging-friendly smart home appliances to develop from the initial "one thing with multiple connections" to today's "Internet of Everything" environment. At present, all terminal devices involved in the Internet of Things in the smart home scene can become the entrance of human-computer interaction. The aging-appropriate interactive experience design for the elderly is no longer just around a single terminal, but a combination of multiple terminals. Home appliances suitable for the elderly use mobile phones, sensors and other media to switch between different scenarios at will. Based on the needs of elderly users in different scenarios, they are demand-oriented, comprehensively analyze user portraits, and accurately gain insight into the daily use behaviors, habits and preferences of elderly groups. The adaptive method provides emotional service content, enhances the elderly's cognition and recognition of home appliances suitable for the elderly, and enables the elderly to

communicate and connect with others through products [23]. At present, my country's pension model is mainly based on home-based pension, and the family is still the leading force for the elderly to integrate into "digital life". With the help and guidance of family members, the elderly can connect with the products in the "digital life" more quickly, and have a more targeted understanding, contact and use of smart home appliances for the elderly, and then enjoy the convenience brought by the "digital life". and happiness [24].

To sum up, in the next few years, the good thing about the development of user experience design for age-appropriate home appliances is that my country's political environment is relatively stable. The Chinese government attaches great importance to the aging industry, and this emphasis will continue for a long time. From the economic and social aspects, my country's economy continues to develop rapidly, the degree of aging continues to deepen, the market for the elderly group continues to expand, and the purchasing power of the people continues to increase, which will provide continuous support for the development of user experience research and practice for elderly home appliances; In addition, technological advances, the Internet of Things and artificial intelligence enable the home furnishing industry to move towards a full-scene service model. Through the interaction of various products and users in the smart home, the elderly group can improve the experience, recognition and recognition of suitable home appliances, which is convenient for the market expansion of the suitable home appliance industry.

4.2 "digital life" era meets the challenges of user experience design development of Hometown TV

According to the above PEST background analysis of The "digital life" era and the development trend of The current stage, the new challenges that the design and development of The Company will face are analyzed.

4.2.1 Adapt to the development of new needs of user groups

Affected by the epidemic, people have higher expectations for health and safety, and the concept of home appliance health has also received attention. The awareness of health and safety of the elderly is becoming stronger and stronger, and the demand for health and safety protection of household appliances is also increasing. In the future, the local electricity industry needs to conduct research and analysis on the demand factors for safety and health of elderly users, and seize the new opportunities brought by the gradual transfer and upgrading of consumer demand. For example, according to the needs of users, create healthy life scenes adapted to modern lifestyle, and bring users a higher quality and practical healthy life system through the way of "intelligent + health", and provide necessary all-round services to meet the needs of the elderly for a better life [25]. Carry out security technology product research and development, provide security service guarantee for aging household appliances in different scenarios, and ensure product and personal information security.

4.2.2 Personalized customization service from the perspective of scene

Professor Penlan once pointed out in his research: "In the mobile era, the thinking of providing targeted content and services for different scenarios has emerged. [26] "At the present stage, household electrical appliances in China have been adjusted and improved for aging by simplifying product functions and operation modes, so as to solve the use problem of the elderly group. However, it is only based on the perspective of universal design to build smart home appliances that can be used by everyone. There are few age-appropriate home appliances designed for special elderly groups or special scenes of elderly groups. In view of different home scenes of elderly groups and special elderly users, users' needs should be mined based on geographical time and space, surrounding scenery, psychological state, social atmosphere and other information of users, and personalized scene services should be finally provided [27].

4.2.3 Experience can enhance the cognition of intelligent life of the elderly group

In the face of the increasingly intelligent development of age-appropriate home appliances, new technologies not only empower individuals, but also bring about a distinct digital divide. While creating age-appropriate products and services, we also need to improve the awareness of the elderly for age-appropriate products [28]. As more challenging competition from diverse markets intensifies, many organizations foster customer loyalty through experience design, service and management innovation. The "experience empowerment" strategy is an enabling strategy driven by experience design. With the help of the thinking and methods of experience design, elderly users can have absolute dominance, choice and control when using products or experiencing services, so that they can obtain comprehensive empowerment from sensory perception, behavioral participation, emotional emotion, mental cognition, social relationship and meaning of life. In the context of shared home, elderly users "empower themselves" through participation, collaboration, communication and other behaviors, but also "empower each other" with family members or other elderly users in service contact and communication behaviors. Through the communication, collaboration and sharing between users in the family scene, the cognition of age-appropriate home appliances is improved, and mutual empowerment of behavior and emotion as well as social empowerment of values is obtained [29].

5. Conclusion

The development of home appliances suitable for the elderly in the context of "digital age" has changed the lifestyle of the elderly group. This improves the awareness and recognition of home appliances suitable for the elderly. In order to adapt to the continuous progress of technological means, the development of new needs of user groups, good user experience as an important principle of product or service innovation, new user experience challenges emerge one after another, research on user experience still has its irreplaceable importance. However, with the change of experience design paradigm, the subsequent user experience thinking of home appliances suitable for the elderly

will gradually change into the experience design thinking of not only the user experience of the Elderly group but also the construction of lifestyle, fashion trend and culture[18].

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